

REMARKS/ARGUMENTS

In view of the foregoing amendments and the following remarks, the applicant respectfully submits that the pending claims are not anticipated under 35 U.S.C. § 102 and are not rendered obvious under 35 U.S.C. § 103. Accordingly, it is believed that this application is in condition for allowance. **If, however, the Examiner believes that there are any unresolved issues, or believes that some or all of the claims are not in condition for allowance, the applicant respectfully requests that the Examiner contact the undersigned to schedule a telephone Examiner Interview before any further actions on the merits.**

INTRODUCTION

Claims 1-5, 7, 16-20, 24-26 and 29 were rejected. Claims 6, 8-10, 13-15, 21-23, 28 and 30-34 were objected to as being dependent upon a rejected base claim but were found to be allowable if rewritten in independent form. Claims 11, 12 and 27 are withdrawn.

Claims 1, 4, 6, 8, 14, 15, 21-24, 28, 30 and 34 have been amended. Claims 3, 19 and 20 have been cancelled. Claims 11, 12 and 27 have been withdrawn. New dependent claims 35-50 have been added. Currently claims 1-2, 4-18, and 21-50 are pending

The applicant will now address each of the issues raised in the outstanding Office Action.

OBJECTIONS

The Examiner indicated that Claims 6, 8-10, 13-15, 21-23, 28 and 30-34 are objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form. Accordingly dependent original claims 6, 8, 14, 15, 21, 22, 23, 28, 30 and 34 have been rewritten in independent form and are thus allowable. Dependent claims 10 and 13, by virtue of their dependency from independent claim 6 (as amended), are also allowable. Dependent claim 9, by virtue of its dependency from independent claim 8 (as amended), is also allowable. Dependent claim 31, by virtue of its dependency from independent claim 30 (as amended), is also allowable. Dependent claims 32 and 33, by virtue of their dependency from independent claim 28 (as amended), are also allowable.

REJECTIONS

Various prior art citations used by the Examiner in rejections and the present invention will be briefly summarized.

Bessho et al. US6614000B1

The Bessho apparatus uses a cylindrical waveguide. The torch does not appear in an open environment. The device operates using a relatively very high power microwave source, and thus it needs water cooling in the setup. In addition, the device needs complicated microwave plumbing including stub tuner and mode converter to achieve good microwave coupling from source

to the waveguide. The setup is not portable. The apparatus needs high gas flow in its operation to blow the plasma out of waveguide and pass a confining tube before reaching the target.

Barmatz et al. US005847355 A

The Barmatz apparatus is a microwave oven with an arrangement to produce plasma inside the oven to help for heating. It uses TE₁₀₂ mode to minimize the microwave electric field in the center, where an alumina rod is inserted to produce plasma around the rod. This device uses TE₁₀₂ mode only (optimal condition). Plasma is not produced in an open environment. The device uses helium gas to reduce the microwave breakdown threshold requirement and to stabilize the discharge.

Blum et al. US 6388225 B1

In the Blum apparatus, a torch is produced by microwave discharge. Thus, microwave has to exceed the breakdown threshold power requirement. An antenna inside the cavity and a coaxial structure outside the cavity are used to couple microwaves out of waveguide cavity for plasma generation. A (large) gas flow rate is required in its operation.

Claimed Invention

In contrast to the above prior art references, various embodiments of the present invention use an arc seeding arrangement which has one or more of the following advantages:

- a) microwave has no threshold power requirement;

- b) no gas flow requirement in its operation;
- c) coupling microwave to torch is done by a simple hole on the surface of the cavity;
- d) tapered waveguide cavity enhances the coupling; and
- e) it is portable.

Rejections under 35 U.S.C. § 102

Claims 1, 3, 24 and 26 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,847,355 ("the Barmatz patent").

Claims 1-3, 7, 24 and 29 stand rejected under 35 U.S.C. § 102(a) as being anticipated by U.S. Patent No. 6,614,000 ("the Bessho patent").

The applicant respectfully requests that the Examiner reconsider and withdraw these grounds of rejection in view of the following.

Independent claim 1 has been amended to more clearly distinguish the claimed subject matter over the cited art. Claim 3 has been cancelled so the rejection with respect to claim 3 is moot. Independent claim 1 (as amended) recites:

An apparatus for generating at least one hybrid arc/microwave plasma discharge, the apparatus comprising:

- a) a cavity adapted to support at least one of a TE mode and a TM mode at a microwave frequency;
- b) an **arc** torch module, coupled with the cavity, for generating seed plasma within the cavity; and

c) a microwave source, coupled with the cavity, for generating microwaves at the microwave frequency, and for introducing the generated microwaves into the cavity, **wherein the arc torch module is capable of generating a plasma torch which exits the cavity in the absence of microwave energy**, said generated plasma torch having a first energy level.
[Emphasis added.]

In contrast, the Barmatz and Bessho patents do not disclose an **arc** torch module wherein the arc torch module is capable of generating a plasma torch which exits the cavity in the **absence of microwave energy**. In view of the above, amended claim 1 (as amended) is neither anticipated by the Barmatz patent, nor by the Bessho patent. Since claims 2, 4, 5, 7, 16-18, 35-42, 44, and 46-50 depend, either directly or indirectly, from independent claim 1 (as amended), they are similarly neither anticipated by the Barmatz patent, nor by the Bessho patent. Withdrawn claims 11 and 12 should be rejoined if claim 1 is allowed.

Independent claim 24 has been amended to more clearly distinguish the claimed subject matter over the cited art. Independent claim 24 (as amended) recites:

An apparatus for supporting generation of at least one hybrid arc/microwave plasma discharge, the apparatus comprising:

- a) a cavity supporting at least one of a TE mode and a TM mode at a microwave frequency; and
- b) means for coupling at least one **arc** torch module to said cavity;
- c) means for a plasma torch to exit the cavity,

wherein said **means for coupling at least one arc torch module to said cavity is on a first wall** of the cavity, wherein said **means for a plasma source to exit the cavity is located on a second wall** of the cavity, wherein said **first and second walls are different**, and wherein said **first and second walls are substantially planar**. [Emphasis added.]

In contrast, the Barmatz and Bessho patents do not disclose an apparatus including a means for coupling an arc torch module on a first cavity wall and a means for a plasma source to exit on a second cavity wall wherein said first and second walls are **different** and wherein said first and second walls are **substantially planar**. In view of the above, amended claim 24 (as amended) is neither anticipated by the Barmatz patent, nor by the Bessho patent. Since claims 25, 26, 29 and 45 depend, either directly or indirectly, from claim 24, they are similarly neither anticipated by the Barmatz patent, nor by the Bessho patent. Withdrawn claim 27 should be rejoined if claim 24 is allowed.

Rejections under 35 U.S.C. § 103

Claims 4, 5, 16-18 and 25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the Bessho patent in view of U.S. Patent No. 6,388,225 ("the Blum patent").

Claims 4, 5 and 16-18, depend, either directly or indirectly, from independent claim 1 (as amended), and the combination of the Bessho patent and the Blum patent neither teaches, nor suggests, an **arc** torch module that

is capable of generating a plasma torch which exits the cavity in the **absence of microwave energy**, as recited in claim 1 (as amended). Thus, claims 4, 5 and 16-18 are not rendered obvious by the Bessho patent in view of the Blum patent for at least this reason.

The Bessho patent in combination with the Blum patent neither teaches, nor suggests, an apparatus including means for coupling an arc torch module on a first cavity wall and means for a plasma source to exit on a second cavity wall, wherein said first and second walls are **different** and wherein said first and second walls are **substantially planar**, as recited in independent claim 24 (as amended). Since claim 25 depends from independent claim 24 (as amended), it is similarly allowable.

Claims 19 and 20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the Bessho patent in view of U.S. Patent No. 6,329,628 ("the Kuo patent"). Since claims 19 and 20 have been cancelled, the rejection with respect to these claims is moot.

New Claims

New dependent claims 35-42, 44, and 46-50 depend from independent claim 1 (as amended), and recite various features which further distinguish them over the cited prior art references.

New dependent claims 43 and 45, depend from claims 18 and 26, respectively, and recite features of the

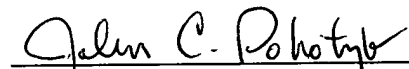
present invention which further distinguish them over the cited prior art references.

Conclusion

In view of the foregoing amendments and remarks, the applicant respectfully submits that the pending claims are in condition for allowance. Accordingly, the applicant requests that the Examiner pass this application to issue.

Respectfully submitted,

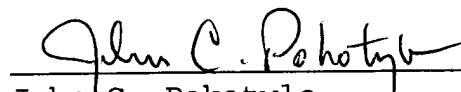
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